

U.S. Patent Application Serial No. 10/562,644

Response filed December 8, 2006

Reply to OA dated August 8, 2006

AMENDMENTS TO THE CLAIMS

Please amend claims 1 and 2, as follows. This listing of claims will replace all prior versions, and listings, of claims in the application:

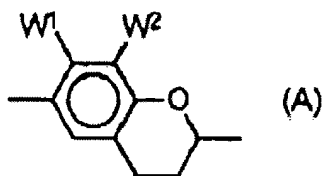
Claim 1 (Currently Amended): A liquid crystal display element:

having a structure comprising a pair of substrates, and a the liquid crystal composition of claim 3 sandwiched between the substrates;

comprising at least an alignment control layer, a transparent electrode, and a polarizing plate;

and

~~characterized in that the liquid crystal composition comprises at least one liquid crystal compound having a partial structure represented by general formula (A):~~



~~(wherein W¹ and W² each independently represents fluorine, chlorine, CF₃, CF₂H, OCF₃, or OCF₂H) and has a negative dielectric anisotropy.~~

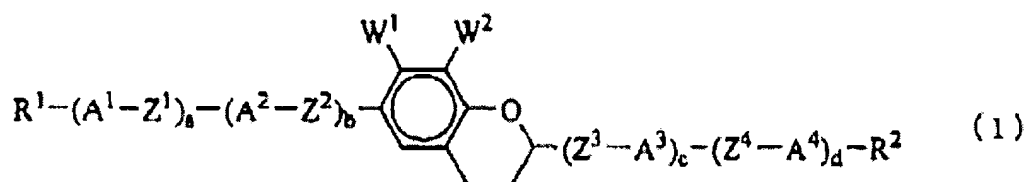
Claim 2 (Currently Amended): A liquid crystal display element according to claim 1, wherein W¹ and W² represent fluorine ~~in the general formula (A).~~

U.S. Patent Application Serial No. 10/562,644

Response filed December 8, 2006

Reply to OA dated August 8, 2006

Claim 3 (Previously Presented): A compound represented by general formula (1):



(wherein

R^1 and R^2 each independently represents hydrogen, an alkyl group having 1 to 12 carbon atoms or an alkenyl group having 2 to 12 carbon atoms, in which one CH_2 group or at least two CH_2 groups that are not adjacent to each other may be substituted

by oxygen or sulfur, or in which at least one hydrogen may be substituted by fluorine or chlorine,

A^1 , A^2 , A^3 , and A^4 each independently represents a trans-1, 4-cyclohexylene group (in which one CH_2 group or two CH_2 groups that are not adjacent to each other may be substituted by oxygen or sulfur), a 1,4-phenylene group (in which at least one CH group may be substituted by nitrogen), a 1,4-cyclohexenylene group, a 1,4-bicyclo[2,2.2]octylene group, a piperidine-1,4-diyl group, a naphthalene-2,6-diyl group, a decahydronaphthalene-2,6-diyl group or a 1,2,3,4-tetrahydronaphthalene-2,6-diyl group, in which hydrogen may be substituted by -CN or halogen,

Z^1 , Z^2 , Z^3 , and Z^4 each independently represents $-CH_2CH_2-$, $-CH=CH-$, $-CH(CH_3)CH_2-$, $-CH_2CH(CH_3)-$, $-CH(CH_3)CH(CH_3)-$, $-CF_2CF_2-$, $-CF=CF-$, $-CH_2O-$,

U.S. Patent Application Serial No. 10/562,644

Response filed December 8, 2006

Reply to OA dated August 8, 2006

-OCH₂-, -OCH(CH₃)-, -CH(CH₃)O-, -(CH₂)₄-, -(CH₂)₃O-, -O(CH₂)₃-, -C≡C-, -CF₂O-,

-OCF₂-, -COO-, -OCO-, -COS-, -SCO-, or a single bond,

when A¹, A², A³, A⁴, Z¹, Z², Z³, and Z⁴ respectively exist in plural, they may be identical to each other or different from each other,

a, b, c, and d each independently represents 0 or 1, and

W¹ and W² each independently represents fluorine, chlorine, -CF₃, -CF₂H, -OCF₃, or -OCF₂H).

Claim 4 (Previously Presented): A compound according to claim 3, wherein R¹ and R² each independently represents an alkyl group having 1 to 7 carbon atoms or an alkenyl group having 2 to 7 carbon atoms (in which one CH₂ group may be substituted by oxygen), and W¹ and W² represent fluorine in the general formula (1).

Claim 5 (Previously Presented): A compound according to claim 3, wherein A¹, A², A³ and A⁴ each independently represents a trans,1,4-cyclohexylene group, a 1,4-phenylene group which may be substituted by at least one fluorine, or a 1,4-bicyclo[2.2.2]octylene group in the general formula (1).

Claim 6 (Previously Presented): A compound according to claim 3, wherein Z¹, Z², Z³, and Z⁴ each independently represents -CH₂CH₂-, -CH=CH-,

U.S. Patent Application Serial No. 10/562,644

Response filed December 8, 2006

Reply to OA dated August 8, 2006

-CF₂CF₂-, -CF=CF-, -CH₂O-, -OCH₂-, -C≡C-, -CF₂O-, -OCF₂- or a single bond in the general formula (1).

Claim 7 (Previously Presented): A compound according to claim 3, wherein the sum of a, b, c, and d is 1 or 2 in the general formula (1).

Claim 8 (Previously Presented): A compound according to claim 3, wherein R¹ and R² each independently represents an alkyl group having 1 to 7 carbon atoms or an alkenyl group having 2 to 7 carbon atoms (in which a CH₂ group may be substituted by oxygen), W¹ and W² represent fluorine, A¹, A², A³, and A⁴ each independently represents a trans-1,4-cyclohexylene group, a 1,4-phenylene group which may be substituted by at least one fluorine, or a 1,4-bicyclo[2.2.2]octylene group, Z¹, Z², Z³ and Z⁴ each independently represents -CH₂CH₂-, -CH=CH-, -CF₂CF₂-, -CF=CF-, -CH₂O-, -OCH₂-, -C≡C-, -CF₂O-, -OCF₂-, or a single bond, and the sum of a, b, c, and d is 1 or 2 in the general formula (1).

Claim 9 (Previously Presented): A compound according to claim 3, wherein R¹ and R² each independently represents an alkyl group having 1 to 7 carbon atoms, an alkenyl group having 2 to 7 carbon atoms, or an alkoxy group having 1 to 7 carbon atoms, A¹, A², A³, and A⁴ each independently represents a trans-1,4-cyclohexylene group, a 1,4-phenylene group, a 2-fluoro-1,4-phenylene group, a 3-fluoro-1,4-phenylene group, or a 2,3-difluoro-1,4-phenylene group, Z¹, Z², Z³,

U.S. Patent Application Serial No. 10/562,644

Response filed December 8, 2006

Reply to OA dated August 8, 2006

and Z⁴ each independently represents -CH₂CH₂-, -CH₂O-, -OCH₂-, or a single bond, W¹ and W² represent fluorine, and the sum of a, b, c, and d is 1 or 2 in the general formula (1).

Claim 10 (Previously Presented): A compound according to claim 9, wherein A¹, A², A³, and A⁴ each independently represents a trans-1,4-cyclohexylene group or a 1,4-phenylene group in the general formula (1).

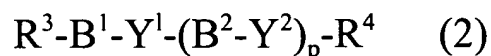
Claim 11 (Canceled).

Claim 12 (Canceled).

Claim 13 (Previously Presented): A liquid crystal composition comprising at least one liquid crystal compound according to claim 3.

Claim 14 (Canceled).

Claim 15 (Previously Presented): A liquid crystal composition according to claim 13, comprising at least one compound represented by general formula (2):



(wherein,

U.S. Patent Application Serial No. **10/562,644**

Response filed December 8, 2006

Reply to OA dated August 8, 2006

R³ and R⁴ each independently represents hydrogen, an alkyl group having 1 to 12 carbon atoms or an alkenyl group having 2 to 12 carbon atoms, in which one CH₂ group or at least two CH₂ groups that are not adjacent to each other may be substituted by oxygen or sulfur, or in which at least one hydrogen may be substituted by fluorine or chlorine,

B¹ and B² each independently represents a trans-1,4-cyclohexylene group (in which one CH₂ group or two CH₂ groups that are not adjacent to each other may be substituted by oxygen or sulfur), a 1,4-phenylene group (in which at least one CH group may be substituted by nitrogen), a 1,4-cyclohexenylene group, a 1,4-bicyclo[2.2.2]octylene group, a piperidine-1,4-diyl group, a naphthalene-2,6-diyl group, a decahydronaphthalene-2,6-diyl group or a 1,2,3,4-tetrahydronaphthalene-2,6-diyl group, in which hydrogen may be substituted by -CN or halogen,

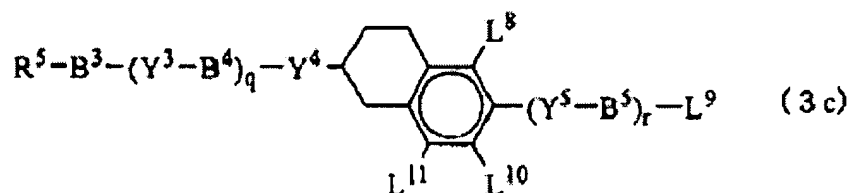
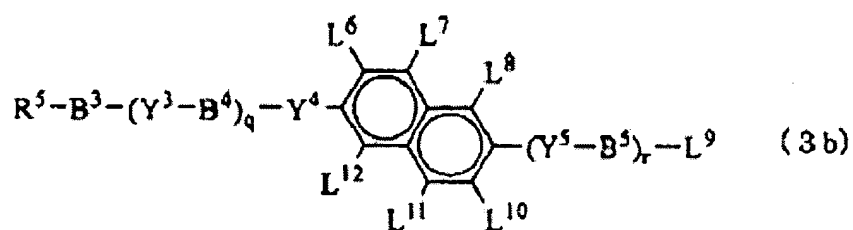
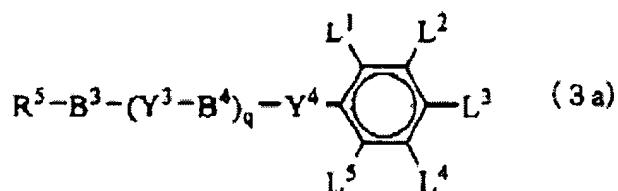
Y¹ and Y² each independently represents -CH₂CH₂-, -CH=CH-, -CH(CH₃)CH₂-, -CH₂CH(CH₃)-, -CH(CH₃)CH(CH₃)-, -CF₂CF₂-, -CF=CF-, -CH₂O-, -OCH₂-, -OCH(CH₃)-, -CH(CH₃)O-, -(CH₂)₄-, -(CH₂)₃O-, -O(CH₂)₃-, -C≡C-, -CF₂O-, -OCF₂-, -COO-, -OCO-, -COS-, -SCO-, or a single bond,

when Y² and B² respectively exist in plural, they may be identical to each other or different from each other, and

p represents 0, 1 or 2).

Claim 16 (Previously Presented): A liquid crystal display element according to claim 1, comprising at least one compound represented by the general formula (2).

Claim 17 (Previously Presented): A liquid crystal composition according to claim 13, comprising at least one compound selected from the group consisting of compounds represented by general formula (3a), general formula (3b), and general formula (3c):



(wherein

R^5 represents hydrogen, an alkyl group having 1 to 12 carbon atoms or an alkenyl group having 2 to 12 carbon atoms, in which one CH_2 group or at least two CH_2 groups that are not adjacent to each other may be substituted by oxygen or sulfur, or in which at least one hydrogen may be substituted by fluorine or chlorine,

B³, B⁴, and B⁵ each independently represents a trans-1,4-cyclohexylene group (in which one CH₂ group or two CH₂ groups that are not adjacent to each other may be substituted by oxygen or sulfur), a 1,4-phenylene group (in which at least one CH group may be substituted by nitrogen), a 1,4-cyclohexenylene group, a 1,4-bicyclo[2.2.2]octylene group, a piperidine-1,4-diyl group, a naphthalene-2,6-diyl group, a decahydronaphthalene-2,6-diyl group or a 1,2,3,4-tetrahydronaphthalene-2,6-diyl group, in which hydrogen may be substituted by -CN or halogen,

Y³, Y⁴, and Y⁵ each independently represents -CH₂CH₂-, -CH=CH-, -CH(CH₃)CH₂-, -CH₂CH(CH₃)-, -CH(CH₃)CH(CH₃)-, -CF₂CF₂-, -CF=CF-, -CH₂O-, -OCH₂-, -OCH(CH₃)-, -CH(CH₃)O-, -(CH₂)₄-, -(CH₂)₃O-, -O(CH₂)₃-, -C≡C-, -CF₂O-, -OCF₂-, -COO-, -OCO-, -COS-, -SCO-, or a single bond,

L¹, L², L⁴, L⁵, L⁶, L⁷, L⁸, L¹⁰, L¹¹, and L¹² each independently represents hydrogen or fluorine,

q and r each independently represents 0, 1, or 2, provided that the sum of q and r is no more than 2, and

L³ and L⁹ each independently represents hydrogen, fluorine, chlorine, -CN, -CF₃, -OCH₂F, -OCHF₂, -OCF₃, -CH₂CF₃, or the same meaning as R⁵),

U.S. Patent Application Serial No. **10/562,644**

Response filed December 8, 2006

Reply to OA dated August 8, 2006

Claim 18 (Previously Presented): A liquid crystal composition according to claim 13, wherein a content ratio of the liquid crystal compound according to represented by general formula (1) is 2 to 30% by mass.

Claim 19 (Previously Presented): A liquid crystal composition according to claim 13, wherein the liquid crystal composition has a dielectric anisotropy value of no more than -0.2.

Claim 20 (Previously Presented): A liquid crystal display element according to claim 1, wherein the liquid crystal display element has an active matrix drive system.

Claim 21 (Previously Presented): A liquid crystal display element according to claim 1, wherein the liquid crystal display element has a liquid crystal alignment regulated by the alignment control layer to be vertical to a surface of the substrate.